ERIC Document Resume	See Instruction Sheet	DATE OF RESUME	DATE RECEIVED

A. PUBLICATION DATA

1. ERIC NUMBER	2. ORIGINATOR CONTROL NO(S).	3. IDENTIFICATION NO.	DO NOT WRITE IN SPACE BELOW
ED001195	N.A.	CR 1383	

4. AUTHOR(S):
Roy, Howard L., Schein, Jerome D., and Frisina, D. Robert

5. TITLE OF DOCUMENT ABSTRACTED:
New Methods of Language Development for Deaf Children

6. PUBLICATION TITLE:
N.A.

7. EDITOR(S):
N.A.

8. PLACE OF ORIGIN
ORG. Gallaudet College
ST. Washington, DC
CITY, STATE

9. PUBLISHER OR SOURCE Cooperative Research Program, Office of Education, Dept. of Health, Education, & Welfare, Wash., D.C.

TELE. EXT.
INST/LOC CODE

10. VOL.	11. PAGES	12. MO./YR.	13. TOTAL PP.
N.A.	N.A.	64	83

MICROFILM COPY AVAILABLE
YES [X] NO [ ]

COPYRIGHT GRANTED
YES [ ] NO [X]

COPYRIGHT RELEASE FILED
YES [ ] NO [ ]

TYPE OF REPORT
PROPOSAL [ ]
IN-PROGRESS [ ]
FINAL [X]
FOLLOW-UP [ ]

OTHER ERIC REFERENCES:

ERIC SATELLITE CODE

B. INDEXING DATA

14. SUBJECT AREA

15. TYPE OF ENDEAVOR
experimental research

16. INDEXING TERMS (6-12)

teaching aids	reading abilities	audio-visual methods		
typewriter uses	communication	language development		
language study	deaf children	prelingually deaf		

17. ABSTRACT (MAX. 250 WORDS)

Some recent innovations in teaching language were investigated. The techniques of programmed instruction were merged with the use of an electric typewriter to provide the means of teaching reading, the aspect of language chosen for study, to young deaf children. Deaf children ranging in age from three to seven years participated in this study. As a group they tended to be of average intelligence and socio-economic status. Deaf children from three years and up can learn to use an electric typewriter within a very short period of time. Programmed instruction can produce significant improvement in language, and it would appear that the most successful approach for language instruction of this group of children would be to include the typewriter as a part of the language program. Such a curriculum would coordinate language exercises on the typewriter with current methods of imparting language to these children.

ERIC No.	18. SOURCE OF ABSTRACT		
	C. FUNDING DATA		
	19. SUPPORTING ORGANIZATION	20. DIVISION OR DEPT.	21. CONTRACT NO. PROJECT NO.
		22. TOTAL COST OF PROJECT	
		23. DURATION OF PROJECT	U.S. Department of Health, Education, and Welfare Office of Education

ERIC Form 1

ED001195

NEW METHODS OF LANGUAGE DEVELOPMENT FOR DEAF CHILDREN

Cooperative Research Project No. 1383

Howard L. Roy, Ph.D.

Jerome D. Schein, Ph.D.

D. Robert Frisina, Ph.D.

Gallaudet College
Washington, D.C.

1964

The research reported herein was supported by the Cooperative Research Program of the Office of Education, U.S. Department of Health, Education, and Welfare.

Table of Contents

Acknowledgments..... i

Introduction..... 1
- Problem..... 1
- Background..... 3
- Objectives of this Project..... 7

Methods..... 11
- The Equipment..... 11
- The Programs..... 14
- The Tests..... 22
- Description of Subjects..... 24

Results..... 27
- The Typing Program..... 27
- The Language Program..... 30
- The Paired-Associate Program..... 37
- Reading Achievement..... 38

Discussion..... 42

Summary and Conclusions..... 51

References..... 56

Appendix A: Typing Program..... 58

Appendix B: Program for Film Tutor..... 61

Appendix C: Program for Paired-Associate Learning.. 67

Appendix D: Special tests..... 69
- Picture Vocabulary Test..... 70
- Scrambled Sentences Test..... 74
- Syntactical Relations Test..... 75

List of Tables

		Page
1.	Sex, Mean Age, Socio-Economic Status, and Intelligence of the Experimental and Control Groups in the Typing, Language, and Paired Associates Programs	26
2.	Average Number of Trials to Achieve Typing Criterion by Age Groups	28
3.	Average Differences in Picture Vocabulary Scores for Experimental and Control Groups I and II	31
4.	Average Differences in Scrambled Sentences Scores for Experimental and Control Groups I and II	32
5.	Average Syntax Scores for Experimental and Control Group II	33
6.	Average Differences in Gates Word Recognition Scores for Experimental and Control Groups I and II	34
7.	Average Differences in Gates Sentence Scores for Experimental and Control Groups I and II	35
8.	Mean Differences in Raw Scores between Pretest and Posttest Scores on Language Tests of Experimental and Control Groups I and II	36
9.	Average Gates Reading Test Scores (Part A: Word Recognition, Part B: Sentence Reading) at Start and End of Experiments with Preschool and Primary Experimental and Control Groups I and II	39
10.	Average Gates Reading Grades (Part A: Word Recognition, Part B: Sentence Reading) at Start and End of Experiments with Preschool and Primary Experimental and Control Groups I and II	40

List of Figures

		Following Page
1.	Diagram of visual feedback arrangement used in phases A and B.....	12
2.	Diagram of visual feedback arrangement used in project C.....	12
3.	Picture of young boy using electric typewriter	12
4.	Picture of young girl using electric typewriter	12
5.	Number of trials to reach various criteria in paired-associates program.....	38

Acknowledgments

The completion of this study was made possible by the cooperation and generous help of a number of people. We are grateful to our colleagues at Gallaudet College for encouragement and critical evaluation, as well as for the contribution of many ideas toward the solution of our problems, and to the College administration for generously making available the time and facilities the project required. We wish to thank Miss Frances I. Phillips, Principal, and the teachers of the Kendall School and the staff of the Hearing and Speech Center Preschool for permitting us to work with the children under their care. We gratefully acknowledge the financial support of the United States Office of Education.

We are especially indebted to certain individuals who served beyond the call of duty to assist with this project. We express our appreciation to Francis Mullin for general coordination of the training sessions and much help with the preschool children, to Richard Alexander and Francis Werbickas for developing apparatus and photographing the program material, to Herschel Leibowitz (formerly with the International Business Machines Corporation, now with Pennsylvania State University) for technical consultation, to Phyllis Brawner for typing this report and for maintaining the log books during the study and to Patricia Edelin for psychological testing of the children. We owe our greatest debt to Agnes Padden for her patience and diligence in working with the children.

While we are deeply indebted to all of the people named here, they should in no way be held responsible for any errors or inadequacies that may be found in this project.

Introduction

The Problem

For the prelingually deaf child, the very concept of language must be derived by direct tuition. We usually say that such a child does not acquire language naturally, meaning that he does not profit from all of the incidental learning of which his hearing peer is able to take advantage. Language addressed to the young deaf child means little, since he does not generally perceive it. Nor does he overhear the conversations of others and observe the behavioral consequences of such verbal exchanges. Thus, when he is brought into a formal learning situation, an appreciation of the existence and an understanding of the purposes of language generally are not givens with which his instructor can begin to work.

The language handicap follows the deaf child throughout his life. A major emphasis, then, throughout the education of the deaf is directed toward improving language skills.

This project has concerned itself with developing and testing a technique for teaching one aspect of language, reading. It should be clarified first that the term language as used in this discussion is not synonymous with speech. In fact, speech is subsumed under language as one of the ways in which it is conveyed. We define language as a system of conventionalized signs having the purpose of conveying thoughts and feelings. An inferred symbol set which

is used idiosyncratically for thinking---implied by the term "inner language" (Myklebust, 1961)---would not be included under this definition of language. The definition used here emphasizes the function of interpersonal communication, for which purpose the conventional nature of the symbol set is crucial.

Having defined language in this way, it is apparent that speaking, reading, and writing are means by which language is conveyed. While we may have particular reasons for stressing one or the other of these communication modes in the education of the deaf child, it is apparent that for studies of language development each of them has relevance. For this project we elected reading as the aspect of language development to be studied, because (a) for the child without hearing, vision offers the most accessible educational mode; (b) experimentally, the acquisition of reading ability is readily demonstrable; (c) and of lesser importance heuristically but worth considering nonetheless, the researchers themselves were interested in this particular aspect of communication.

Furthermore, it is our hope that this initial project will encourage further the studies of language development in deaf children. Only recently have linguists become aware of the potentialities of the prelingually deaf child as a research subject in promoting their understanding of how language is

acquired. For the most part, the young deaf child does not benefit from incidental learning; therefore, he offers the possibilities for control not realistically available with other children. In working with young, prelingually deaf children, an experimenter can be reasonably certain that what the child demonstrates by way of language development in his earliest years can be accounted for by the experimental manipulations, of course, provided that the experimenter has control of the teaching situation. As more and more scientists become aware of these possibilities, deaf subjects are apt to become increasingly scarce.

The Background

The research literature on the teach ing of reading to pre-school children is surprisingly barren (Fowler, 1962) Most of the studies consist of anecdotal accounts of reading in exceptionally bright children who have had an unusual amount of stimulation. The literature does suggest that ordinary, non-handicapped children are capable of learning a wide variety of complex material at relatively early ages. Of course, reading has been taught to young deaf children in the past[1], but controlled studies of reading with deaf children are as scant as with hearing children.

---

1 One may, for instance, consider speechreading as another form of reading for the deaf child, since lip movements must be translated into concepts much as printed symbols are.

A search was made for techniques of language teaching which would permit the child to learn to read and to express himself verbally. It seemed that in addition to attaching meaning to a symbol, the child would need to respond if language development were to be fostered. Recently O. K. Moore (Moore and Anderson, 1960) has produced films of 3-year-old, normal hearing children learning to read and write by a method he devised. The child is introduced to a typewriter in a completely permissive atmosphere ("autotelic"[2] is the term used by Moore). When he strikes a key, the instructor voices the name of the letter and, in some cases, its phonetic equivalent. The child progresses through a series of steps to reading printed material[3].

It is at once apparent that Moore's method cannot be applied to deaf children who by definition have no usable hearing for speech---defined in this study as a better-ear-average loss of 70 decibels or more across the "speech frequencies" (500 to 2000 cps.) When deafness of this degree is congenital or occurs prior to the development of speech, the natural acquisition of language is precluded.

A contrast of hearing and deaf children will serve to highlight some aspects of the language learning problem and to indicate why a method such as Moore's is not applicable without modification. The hearing child is stimulated by speech

---

2 "We call <u>autotelic</u> those cultural products that contain their own goals and sources of motivation: puzzles, games, aesthetic objects; such activities are in a sense cut off from serious and immediate problems of survival and welfare" (Anderson and Moore, 1960, p. 203.)

3 This method has now been refined by Moore to replace the instructor by a computer which incorporates tape-recorded speech.

(and other) sounds from the moment of birth. The speech sounds become associated with ideas and concepts. By the time a hearing child begins the study of reading, even at the age of three, he has a substantial vocabulary.[4] Learning to read, then, involves learning the visual symbols representing words and concepts already known to the hearing child. In other words, the hearing child learns to translate from one symbol set (spoken words) to another (printed words)

The use of a typewriter in language instruction has been tried with deaf children by the Russians. The report of N. G. Butkevich was particularly encouraging about its use:

> For children who had mastered the hand alphabet typing proved to be possible even at the age of five. Children of 6 years in the senior group in the third year of instruction already typed single letters to dictation "from objects" in the first 15 minute lesson (typing with two fingers and observing spacing and fresh lines.) During this time they also mastered the appropriate terminology which was being used in setting up and carrying out the exercise. By the sixth lesson the children typed sentences consisting of 2-3 words from a familiar picture without a mistake, using full stops and capital letters for proper nouns and after full stops. At the same time their speed in typing increased from 40-50 strokes in 15 minutes in the first lesson to 75-85 strokes. By the eighth lesson most of the children in the group, and by the tenth all of them, had brought the technique of typing to an average speed of 110-125 strokes in 15 minutes, and by the 15th lesson up to 180 strokes. This experiment showed that children can easily and quickly master the technique of typewriting, a fact which opens up great possibilities in teaching written, connected expression to children of preschool age (Butkevich, 1961, p. 224.)

---

4 "A hearing child, at the age of 5, ready to enter kindergarten, has a vocabulary of 2500 to 4000 words, or perhaps even more. A deaf child, at the same age, has no words. If he has attended preschool, or nursery classes, he may have up to 60 words. This poses a five-year language handicap immediately" (Conklin, 1963, p. 1)

Further support for the use of the typewriter in language acquisition was provided by another Russian, B. D. Korsinskaya:

> Experience shows that the use of a written form of expression, very important in itself, facilitates the development of connected speech. At the same time teaching the technique of writing to children of 5-6 years does not ensure the children will develop an independent written expression. Within the limits of the nursery school the teaching of writing cannot go beyond the ability of the children to write single letters, words, and in individual cases, with the best teachers, short sentences, with a great many mistakes in calligraphy as well. Thus, the teaching of connected expression in written form is not practically possible. Typewriting may be successfully used to develop this ability in children who have mastered each letter individually. Mastery of typing by the children enables them to form the ability of connected expression in printed form. The development of this ability because of its very function represents a development in written speech and both facilitates and improves the habit of connected expression in dactylic and oral form (Korsinskaya, 1961, p. 226)

The typewriter as an aid to learning has also been tried by two other U. S. experimenters. Erickson (1958) taught fifth-grade pupils to type and had them use the typewriter for all their written work. He found more verbal output and "evidence that the wording and content of their reports was improved as well." Doerfler (1941) permitted deaf children to use the typewriter in preparing their lessons. He reported gains in their reading and use of language, which he attributed in part to the greater care and clarity of expression made possible by the typewriter.

Programmed instruction for deaf children has also had some recent attention. Falconer (1961) reports the successful application of a brief vocabulary program. Stuckless and Birch (1962) are engaged in several attempts to program language skills. However, in both cases, the research subjects are eight years of age and more, and, while the progress they report is encouraging, the feasibility of using programmed instruction with younger children remains an open question. Stolurow's (1961) excellent review of the literature on teaching machines does not discuss any studies of their use with children under five years of age.

From published data, then, we could conclude that the typewriter can be used with young children, that it has some value in language instruction, and that programmed instruction for the deaf child is feasible.

Objectives of this Project

The acquisition of new ideas in the development of skills in all aspects of language are reciprocally related. Hence, the more a child develops in one language skill, the easier and faster he can develop the related skills. The deaf child develops language slowly and so is retarded in all skills, be they speaking, reading, or writing.

The primary aim of this project was to investigate methods for accelerating the development of language skills in the deaf

child. To do so, the typewriter was selected as the basic instrument for instruction and the linear teaching program as the method.

While the literature indicated that the typewriter can be handled by primary school children, nothing had been said about its use with the deaf preschool child. The first objective, then, was to demonstrate that the deaf preschool child had the necessary neuromuscular ability to gain control of the typewriter. Secondly, methods of imparting typing skills to the child also needed to be investigated.

After developing a method for teaching typing, it was then necessary to find or build apparatus which would be suitable to language instruction. The major problem to be faced was providing immediate feedback to the child, to let him perceive at once the consequences of his actions, while also giving him a measure of expression to reinforce his perception of language. Considerable time and effort was spent on this phase of the project.

Finally, a linear language program had to be developed which accepted as its basic premise the near-total absence of language in the child to be instructed. The programmed material could not depend upon auditory stimulation nor presume that the child had any previous exposure to formal language. Furthermore, the language program had to provide the child with more than vocabulary. To be more effective than the traditional method, the

program had to provide the child with a grasp of syntax.

Grewel enunciated the problem clearly:

> Learning to understand a language as a whole system of syntactically interwoven signs is too heavy a task for children who have never learned to think in the complicated language system. The use of language in the normal child develops within the reality of the concrete system of that language, just as a child learns to handle his spoon and to manipulate toys. Language is in principle an acoustic-motoric system of symbols arranged according to syntactic rules. When narrating an experience a normal child endeavours at a very early stage to arrange his words more or less according to the rules of the 'grammar' he recalls from what he has heard. The liberation from the concrete during his later development is achieved more through playing with the possibilities of syntax than through an enlargement of his vocabulary for objects, qualities and actions. The connection of the word with the object it denotes is so immediate, that the word becomes the object so to say; it acquires an isomorphy with the object (or quality or action). Syntax on the contrary always demands active manipulation in every new situation.
>
> The deaf child is incapable of learning this gradually because the normal portal of entry for spoken language, the hearing apparatus, is blocked. He does not experience the play with these syntactic relations of words. It is thus comprehensible that he clings to the use of isolated words without a syntax (Grewel, 1963, p. 42)

Admittedly, the time that could be allotted to any one child during this project would be insufficient to give him extensive "play with these syntactic relations of words." Normal language development, whether in terms of reading, writing, or speaking, evolves over many years. This project, then could

only hope to develop techniques for young deaf children to a point that would indicate their possible effectiveness when pursued more intensively and over a longer period of time than was available within the scope of this research project.

METHODS

In order for the research to proceed, both apparatus and programmed materials had to be developed. The section which follows separates the discussion of the equipment from that of the procedures, though in actual practice the two tended to develop more or less at the same time, with attention shifting from one to the other aspect as the experience gained dictated.

The Equipment.

The research design called for equipment which would (a) be operable by very young children, (b) provide immediate visual feedback, (c) permit self-correction of incorrect responses, and (d) be sufficiently flexible to allow for necessary changes as the programmed instruction was tested. The basic unit in the apparatus eventually adopted was the electric typewriter. Early trials with this model typewriter indicated that it required no more physical strength to activate than could be expected from a very young child.

Providing immediate visual feedback turned out to be a far greater problem than was originally anticipated. Attempts to construct an optical projection system using mirrored reflection of the keyboard failed. The failure was largely due to the inability to provide sufficient illumination without excessive heat on the original image. Furthermore, the complexity of any direct optical representation adjusted to a moving carriage proved to be beyond the engineering skill available to us.

A system of instruction in which the machine, not the teacher, would indicate an incorrect response was more readily achieved. The principle we adopted was to cause the machine not to operate unless the proper key was depressed.

The equipment which eventually resulted from a series of trials and errors is represented in Figure 1. As indicated in the illustration, the child is seated at a typewriter ("the master") which activates a second typewriter ("the slave"). The wires leading from the master keyboard pass through a control box which has a throw switch for each key. The teacher can control what is produced on the slave typewriter by opening and closing these switches.

The slave typewriter is behind a screen which hides it from the child. A television camera is focussed on its carriage, and the camera's image is directed onto a television receiver placed at eye level in front of the child. The child's view of this apparatus is presented in Figures 3 and 4.

As will be noted in the two pictures of the apparatus in use, the typewriter mechanism is enclosed in a black box designed to protect the child from being caught in the mechanism and also serving to remove the distraction which the moving parts of the typewriter would cause.

Since the typewriter provides all possible combinations of letters, one part of the demand for flexibility in the apparatus

FIGURE 1

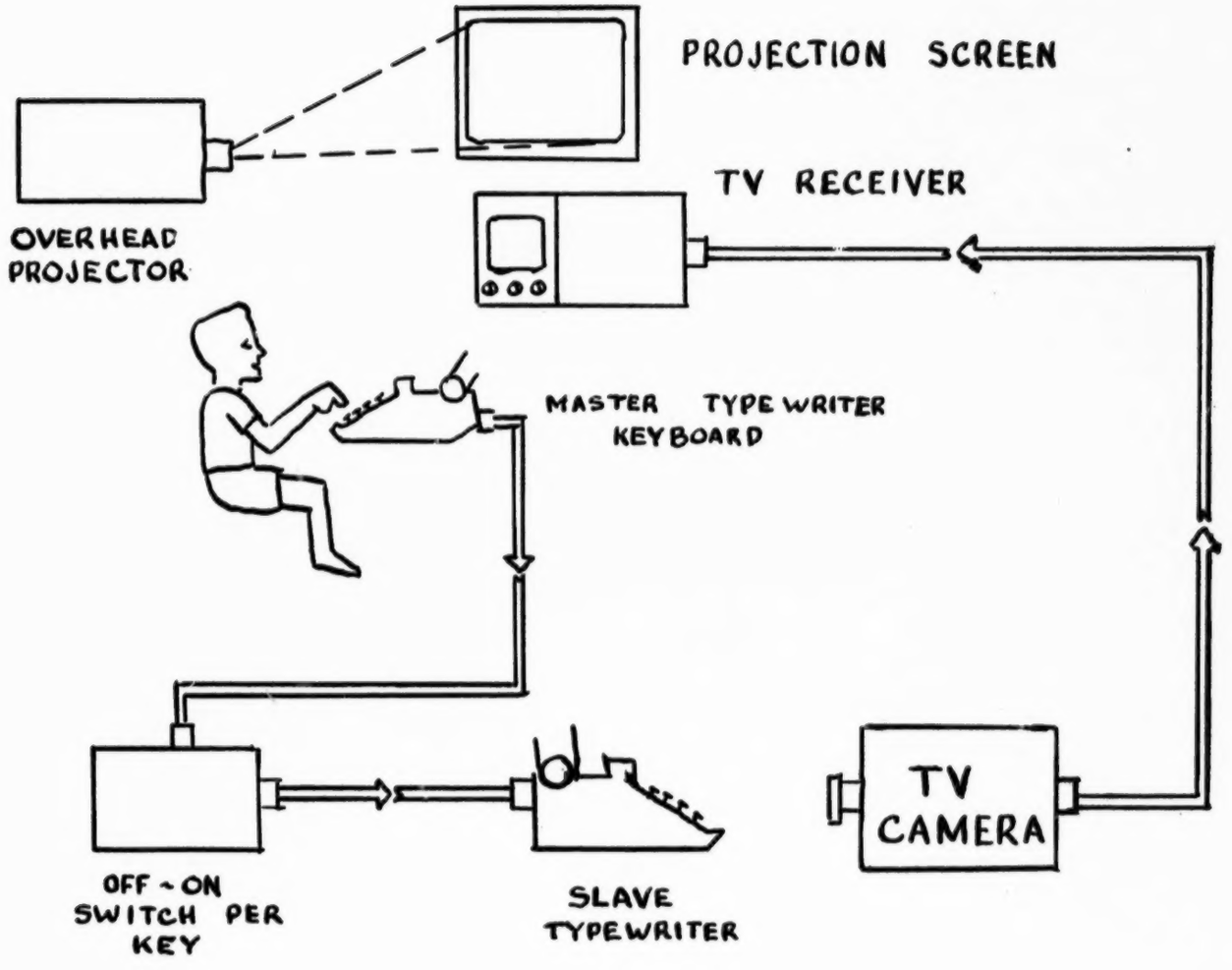


Diagram of Visual Feedback Arrangement Used in Phases A and B

BILL GRUME

FIGURE 2

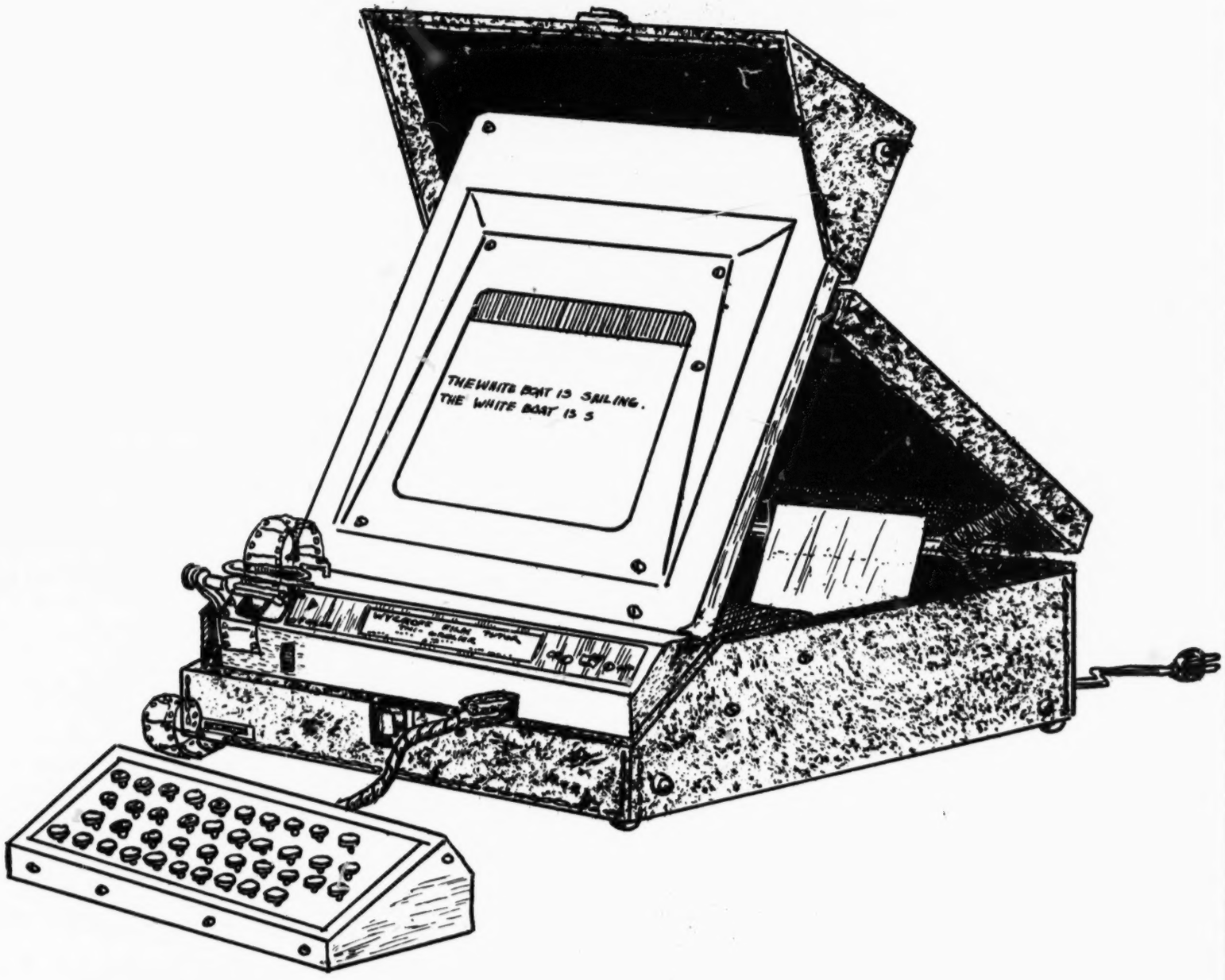
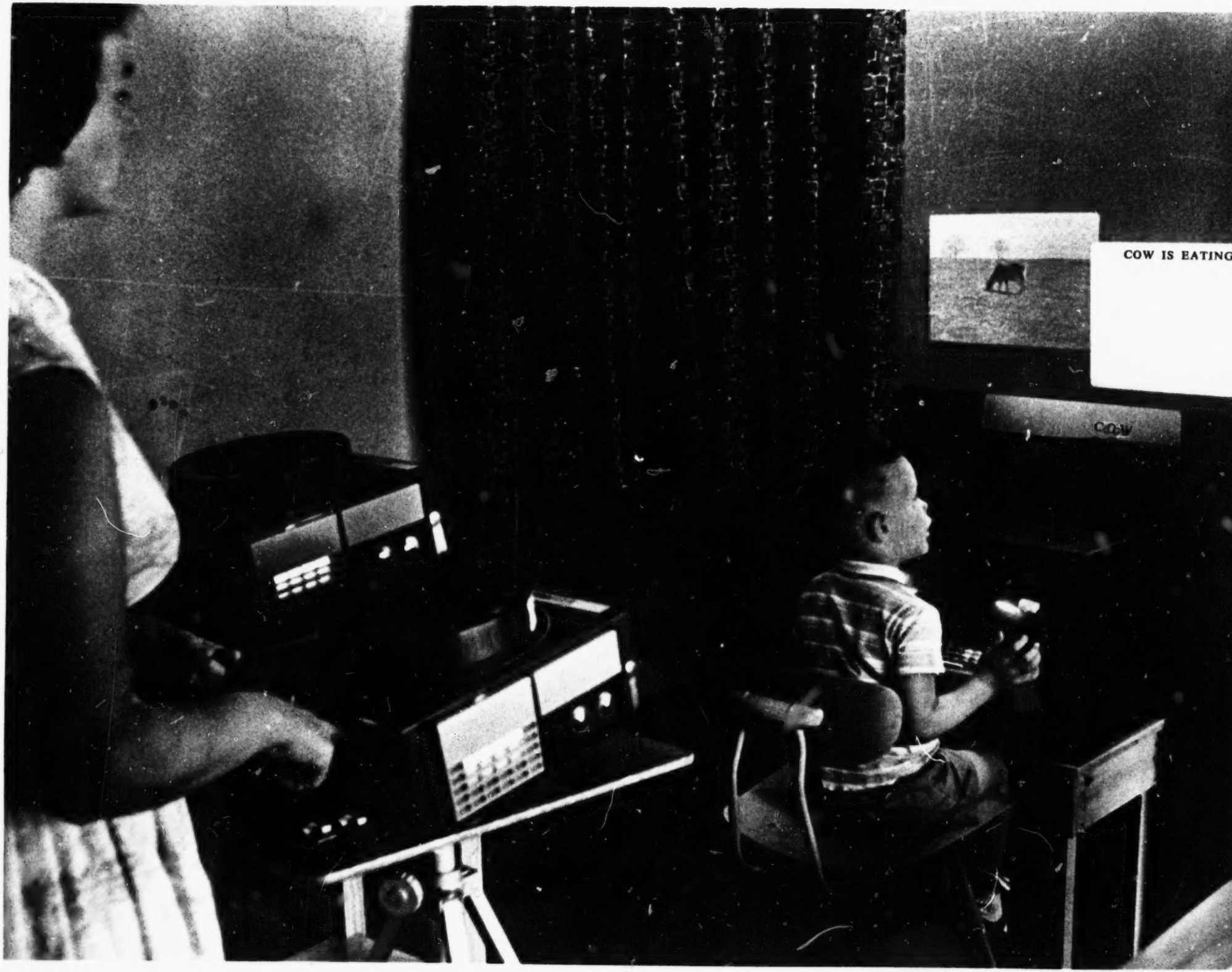


Diagram of Visual Feedback Arrangement used in Project C


COW IS EATING
COW

COW
CAT
COW

was solved by its use. The remaining degree of flexibility had to come from the materials under the teacher's control. This was accomplished by use of slide projectors and movie projectors. Referring again to Figure 1, the material that the teacher wished to present to the child was flashed on the screen just above the television receiver. The materials to be projected and the order of their projection could then be varied to whatever extent was desired.

When the linear teaching program was established, the necessity for this complicated apparatus no longer prevailed. Because of its bulk, it was necessary to bring the students to it, rather than the apparatus to the students. Furthermore, as would be expected, the apparatus was subject to a certain amount of electronic failure from time to time. A simpler, portable teaching machine was therefore sought.

The Wycoff Film Tutor satisfied the need for a lightweight, inexpensive apparatus. It is illustrated in Figure 2. The keyboard which the child manipulates only serves to advance a filmstrip. Whatever is on the frame of the filmstrip is projected onto a mirror at the back of the film tutor and thence onto a screen at eye level. A series of photo-electric cells controls the advance in accordance with a code preprinted on the filmstrips. The apparatus operates, then, very much like the equipment on which the child learned, in the sense that nothing happened when an incorrect response was made. To give the illusion of typing, a separate frame of the filmstrip had to be made for the addition of each letter.

The Programs.

Typing. In order for the children to progress through the programmed language instruction it was first necessary for them to learn to use the typewriter. What is more, they had to be able to type fast enough so that they could perceive units larger than the individual letters they were producing. Accordingly, a program of typing instruction was developed as the starting point for all of the children chosen for the project. The specific objectives of this program were (a) to acquaint the child with the typewriter keyboard, (b) to teach him to strike the keys with the appropriate fingers according to standard typing procedures, and (c) to develop a degree of skill sufficient to permit him to direct his attention less to the keyboard than to the material to be learned.

The complete instructions for this program are presented in Appendix A. The procedure involved painting the child's fingernails to match the corresponding keys which were also colored. After the child had had an opportunity to explore the keyboard a colored circle was projected on the screen above the television receiver. All keys with that color were "open" so that if the child struck any one of them its image would appear on the television receiver. In the next step individual letters were presented, and only the responses to these letters would produce an image on the television screen.

The child progressed in this fashion to groups of letters. His responses appeared on the screen only if he struck each letter with the appropriate finger. The teacher had no difficulty in enforcing this rule since it was easy to anticipate the child's movements and switch off the control key if the child moved to strike it with the wrong finger. The child was considered to have successfully mastered the program when he typed correctly all words in the program with the appropriate fingers.

Free play. Once a successful program to teach the child how to handle the typewriter was completed we directed our attention to the language program. These efforts resulted in three approaches to the problem. The earliest attempt followed the paradigm of the Skinner box, also used by Moore in his "autotelic" approach.

The child entered a room which was bare except for the typewriter with its multicolored keys. The teacher remained in the background, neither encouraging nor discouraging the child from taking any action that he desired. Theoretically, the child would be drawn to the typewriter and would in time begin to explore it, a step which should lead inevitably to his depressing one of the keys. As soon as a key was struck, the screen above the typewriter lit up displaying the letter the child had touched. Through this period of "free play" the child was supposed to learn that his actions controlled what was on the screen, thus establishing the contingency between striking a key and causing a letter to appear.

After a few minutes of this free play, a picture was flashed on the projection screen above the television screen. The first picture used was always a picture of the child himself with his name printed beneath it. At the same time the teacher locked all of the keys on the typewriter except the initial letter in the child's name. The appearance of the picture signaled to the child that a new element had entered the situation. If he struck an incorrect letter, he learned of an added innovation: the loss of some control over the instrument, because nothing would change on the screen. When the child eventually did strike the correct letter it appeared on the screen. The switch activating that key was then closed and the one activating the next letter in the child's name was opened. The process continued seriatim until the child typed his own name. The completion of this task was followed by the presentation of a new picture which was also labeled. The steps were the same as for the child's name.

Since the child was allowed a few minutes of free play at the beginning of each session, he might be expected to attempt one of the words he had learned in a previous lesson during the time he was free to do so. It was hoped that, for instance he would attempt to type his own name during the free period. The plan was to flash his picture on the screen as soon as he had typed his name, or to flash the picture of any other object the name of which he typed. In this way the child could establish further

control over the instrument, now being able to call forth pictures on the projection screen as well as being able to produce letters on the television screen.

So much for the method. How did it work? Seven students were tried for varying lengths of time in this phase of the research. The four preschool children, ranging in age from three to four and a half years, unequivocally failed. An analysis of the protocols makes it clear that two interrelated factors were at work: (a) the permissive atmosphere was frightening and (b) the child's behavior was marked by rigidity. None of the young children were willing to manipulate the typewriter to any great extent, if at all. Most of the time they would stand facing it with their hands behind their back and their heads glancing repeatedly over their shoulder at the teacher. Apparently, their learning histories were such that, even at their young age, they had firmly learned not to touch. Once they had overcome this initial fear, they would tend to repeat continuously a single action, as if to indicate by their behavior that they were unwilling to advance beyond an action that they had found "safe".

With the three older children, ranging in age from six to eleven years,[5] the method did seem to produce the desired results. Because this phase of the experiment was conducted during the exploratory period in which the researchers were attempting to find an applicable procedure for the preschool children, the method was not pursued. Additions to the plan, such as painting the child's fingernails to match the typewriter keys, did not produce significant changes in the younger children's performance. Even with the older children, their inability to type with a fair degree of rapidity clearly impeded their progress in language acquisition. It became obvious, therefore, that this method should not be pursued for the major portion of the study, despite some of its hypothetical advantages. Chief among these was the limitation placed upon the teacher's participation. It is a truism that good teachers can make bad teaching techniques work, while poor teachers often make good techniques fail. With

---

[5] Though not included in the major experiments, the eleven-year-old child's presence anywhere in this research should be explained. He was accepted as a candidate for study in language development, because he had only one year, from seven to eight years of age, in which he was given any formal schooling. He had lost his hearing at 18 months through spinal meningitis. Due to an unfortunate incident at the school he was attending, he was refused further education on moral grounds, and his parents were unable financially to obtain private schooling for the boy. For all intents and purposes, then, he was without language, even without a semi-formal set of family gestures. When his situation was brought to the attention of the experimenters, it was thought profitable for the child and for the research to see how he would progress in the typewriter program. For the period of time that he was a participant, he was able to master the keyboard and produce words both on command and freely. He did not, however, progress in this program to the point of typing complete sentences.

the method proposed, the risk of a single teacher being the sole determinant of the results achieved would be greatly reduced. Furthermore, the generality of the results obtained under such a method would be substantially broadened. Perhaps further research might be attempted along these lines, though the subjects should probably be at least five years of age.

The linear language program. Concurrent with the free play of the investigation a linear language program was developed. It is this program which will be referred to in the remaining sections of this paper as "the language program". The program consisted of 44 blocks of four frames each and was displayed on the Wyckoff Film Tutor. The first filmstrip which is typical of all contained the following:

A DOG

THE WHITE DOG

THE WHITE DOG IS RUNNING

THE WHITE DOG RAN

The full program is given in Appendix B.

The child was introduced to the film tutor, and when he was comfortably seated, the teacher turned on the machine exposing on the screen the first phrase "A Dog". The child proceeded as he had with the other equipment, copying the letters he saw. This time, however, when he had successfully copied the phrase a picture of a dog appeared on the screen.

Upon completion of the phrase "The White Dog is Running", a brief motion picture of a white dog running appeared on the screen. Following the motion picture, the phrase "The White Dog Ran" was presented, but the result of successfully typing this phrase was the presentation of the first phrase in the next block.

The design of the program expresses one means of giving the child a sense of syntax. Each of the 44 blocks begins with the presentation of a noun. Since in the English language nouns are usually preceded by an article, the program does likewise. To the noun is then added an adjective, and this addition is illustrated by a change in the picture which follows the typing of the phrase. The addition of a verb is illustrated by the action it depicts, using for this purpose a film. The past tense is illustrated by its occurrence in the proper sequence, following the action it describes.

This basic program was originally tested with a group of 15 experimental and 15 control children in the Spring of 1963. In the Fall of that year the program was repeated with 10 experimental and 10 control children. The replication was necessary because few of the children were able to progress far enough into the language program during the Spring session to assure the experimenters that the program had been given a true test. By rescheduling the amount of time with fewer children, it was possible to run all of the experimental children through the complete program in the Fall session.

Paired associate program. Yet another approach to programming language instruction was the paired associate learning task. This program was designed to place greater emphasis on expression. After a learning period the child was given the picture and asked to supply the appropriate label. The detailed instructions for the program are presented in Appendix C.

Briefly described, the program was divided into two phases. The child was first presented with a picture alone. He was instructed to type the name of the object in the picture. After a ten-second pause the name of the object was presented beside the picture. The child was then instructed to type (copy) the word. This procedure was followed for individual words. The criterion for success was typing the name of the object correctly prior to the appearance of the name on the screen twice in succession.

The next phase called for the typing of a noun-verb sequence. Again, the picture was presented with the correct label following after a ten-second pause. For example, a dog eating would be shown and ten seconds later "Dog is eating". The criterion was the same as that in the first phase: two successive, correctly typed phrases prior to the presentation of the appropriate response.

General considerations.

For each session, regardless of the program to be used, a permissive atmosphere was maintained. The child was permitted to leave at any time prior to the 15 minutes allowed for each

training session. As an empirical fact, we found the average length of time per session to be a fraction over ten minutes. However, no child was permitted to remain at the typewriter longer than 15 minutes.

Except for the free play experiment described above, the teacher was permitted to actively instruct the child when she felt that this was indicated. With some of the very young children their classroom teacher was permitted to come to the training session with them for the first few trials. Once the child had become acquainted with the experimental situation and the experimental teacher, however, this was unnecessary. For the most part, having overcome their initial fear of a new situation, most of the children found the training session attractive.

The Tests

Tests were used for two purposes: (a) to select matched groups of experimental and control subjects and (b) to provide measures of the gains in language ability resulting from the learning experiences.

Selection of subjects. In addition to age, sex and school experience, intelligence and socio-economic status were considered in matching the experimental and control groups. The appraisal of intelligence in young deaf children required a test which did not depend upon formal language either for its content or administration. For this reason, the Leiter International Performance Scale, Arthur Adaptation, was selected.

Socio-economic status was estimated from the father's occupational level. The scale used consisted of seven steps: 1 = professional and technical; 2 = managers, officials, and owners; 3 = clerical and sales workers; 4 = craftsmen, repairmen, and foremen; 5 = operatives, apprentices, and related workers; 6 = service workers; and 7 = laborers and domestics. The definitions of occupations followed those of the U. S. Bureau of the Census.

Measures of Language Ability. To obtain a broad measure of language development, four tests were originally combined into a battery: the Gates Primary Reading tests, Part A, Word Recognition, and Part B, Sentence Reading, formed two subtests, and the Picture Vocabulary and Scrambled Sentence tests the other half of the battery. The latter two tests were developed for this study, and their complete description appears in Appendix D. For the final testing of the second group in the language program, another test was added to the battery, the Syntactical Relations test (see Appendix D.) Together, these five tests measured responses to visual symbols; they tested reading in one of several ways.

Particular attention should be directed to the last test added, Syntactical Relations. This test is designed to assess the child's grasp of syntax. The vocabulary is simple and, hopefully, known to most of the children. Selecting the correct response depends upon recognizing the part of speech that is missing. The Scrambled Sentences test attempts to get at the same thing in a slightly different fashion. However, because

chance and memory factors can play so much greater a part in Scrambled Sentences, the Syntactical Relations test seems a more incisive measure of this factor.

The total score, as it does in most tests containing subtests, can be expected to yield the most reliable measure, because of its broader sampling of behavior. When dealing with small samples of subjects, the necessity for high test reliability is accentuated before statistically significant differences can be expected. For that reason, the over-all language score is apt to provide the most satisfactory reflection of the experimental approach used in this study.

Description of subjects.

The age, sex, race, socio-economic status, and intelligence of the children in the various experimental and control groups are set forth in Table 1. Each of the children has a better-ear-average loss of 70 decibels or more. All of them were either born deaf deaf or had lost their hearing prior to the development of speech.

The typing group. As the data in Table 1 indicate, the children who took the typing training were "average" in both intelligence (mean=104) and socio-economic status (mean=3.54). They were just under five years of age as a group and had a few more girls than boys. The figures on the children who participated only in the free play experiment, described above, and in the preliminary testing are not included in Table 1 which presents the data only for those who were in the various formal experiments.

The language program groups. The two experimental groups appear to be fairly well matched with their respective control groups on all variables except intelligence. In both cases the control groups have higher average intelligence test scores. This discrepancy in favor of the control groups arose by chance. As was to be expected, the experimental groups suffered a certain amount of attrition in number due to children's illnesses and other reasons that caused them to be dropped from the program. Since matching could not be done on all variables for all children, the original groups were made comparable in total. The loss of a child assigned to the experimental group required dropping his counterpart in the control group, but this did not preserve equality between the groups on all factors. Unfortunately, the difference favoring the control group on intelligence occurred in both the first and second experimental runs.

Paired associates group. The children in this experiment were younger on the average than any of the other groups. In the other aspects reported, they closely resemble the other groups, in that they have about the same mean intelligence and socio-economic status.

TABLE 1.

Sex, Mean Age, Socio-Economic Status, and Intelligence of the Experimental and Control Groups in the Typing, Language, and Paired Associates Programs

	Sex		Age in Years		Socio-Economic Status*		Intelligence	
	Males	Females	Mean	S.D.	Mean	S.D.	Mean	S.D.
Typing Program								
(N=33)	15	18	4.96	1.37	3.54	1.43	104.19	15.22
Language Program								
Experimental I (N=15)	8	7	5.71	1.49	3.60	2.22	103.42	14.87
Control I (N=15)	9	6	5.62	1.49	3.33	1.92	111.77	16.35
Experimental II (N=10)	4	6	5.96	1.33	4.20	2.36	101.30	15.10
Control II (N=10)	4	6	5.99	1.44	3.50	1.91	109.80	14.91
Paired Associates Program (N=10)	5	5	4.21	.42	3.50	.81	104.80	13.74

* 1=highest, 7=lowest socio-economic level. See text for details.

RESULTS

The Typing Program.

As indicated by the statistics in Table 2, the majority of the children were able to achieve the criterion level for typing and to achieve it in a relatively short period of time. All of the children five years of age and older met the criterion. Two of the nine (22%) four-year-olds and three of the nine (33%) three-year-olds did not learn to type to the criterion level. Over-all, 28 of the 33 children (85%) who began the typing program satisfactorily completed it.

It will be noted further in Table 2 that the mean number of sessions required to achieve the prescribed level of typing proficiency was small for each age group. While the maximum time allotted to any given training session was 15 minutes, it should be recalled that the child was permitted to terminate the session whenever he desired to do so; therefore, the sessions averaged 10 minutes, rather than 15 minutes. This means that the three-year-olds took just under four hours on the average to reach the typing criterion. There was very little difference in time for the remaining age groups: the average time to master the keyboard varying from 1.7 to 2.4 hours. When it is considered that this amount of time is spread over several weeks, the typing program appears to accomplish its objective in a relatively brief period of time.

TABLE 2.

Average Number of Trials to Achieve Typing Criterion by Age Groups

Age Group	Number Given Training*	Percent Attaining Criterion	Trials to Criterion		
			Mean	S.D.	Range
3 years	9	67	23.50	4.19	18-29
4 years	9	78	14.29	4.62	8-22
5 years	7	100	10.43	4.03	7-20
6 years	4	100	12.50	2.50	9-16
7 years	4	100	12.00	5.79	8-22
All years	33	85	14.71	6.46	7-29

* Does not include 3 children in preliminary typing program and 4 children in "free play" program.

It should also be noted that three of the four children who failed to satisfy the typing program were in a group studying during the summer when their attendance was highly irregular and the atmospheric conditions for study were less than ideal. Perhaps the success rate for the typing program would have been even higher had it been possible to continue some of these children for a longer period of time. The children had 5, 6, 7 and 13 sessions---all less than the average time to reach the typing criterion for their ages. Of course, we could not know at the time they concluded their brief attempts at the typing program that their age peers would require even more sessions to reach the arbitrary achievement level. However, since they were selected as experimental subjects and since they did not achieve the criterion level during the time available, they were considered as failures in the interest of objectivity.

Aside from the consideration of time and mental ability necessary to achieve the selected level of typing skill, a further consideration was the physical demand which this activity placed on the child. The fact that six children ranging in age from 36 to 47 months were able to successfully complete the program offers some evidence of the little neuromuscular coordination required by this task. One of the three-year-old children who successfully completed the program was a mildly spastic, cerebral-palsied child.

He reached the criterion level in 18 sessions, five less than the average for his age group. The same holds true for a cerebral-palsied girl in the seven-year-age group, who completed the typing program in nine sessions, again less than the average for her group. It would appear, therefore, that the typing program is neither mentally nor physically beyond the ability of the average child of three years to achieve.

The Language Program.

Tables 3 through 7 present the average differences between pretest and posttest scores on the five language tests for the two experimental and control groups. As noted by McNemar (1962), the proper comparison for an experiment such as this one is between the net gain scores for the experimental and control groups. For purposes of ease of reading and ready comparison between the various tests, the scores have been converted to T-scores with the mean set at 50 and the standard deviation at 10. The mean was taken as the average of the scores for both the experimental and control groups separately for the two replications. The same data are presented in raw scores in Table 8 for the two experimental and control groups.

Separate analyses of variance were calculated for each test by level (preschool versus primary) and amount of instruction (less practice versus more practice versus control). None of the differences achieved statistical significance on the Picture Vocabulary, the Syntactical Relations, nor the two Gates reading

TABLE 3.

Average Differences* in Picture Vocabulary Scores for Experimental and Control Groups I and II

	Group I		Group II	
	Experimental	Control	Experimental	Control
Preschool	48.94	43.44	49.11	46.35
Primary	51.24	52.61	49.82	56.65
Less Practice	52.94	49.54	45.88	50.47
More Practice	48.39	49.54	52.50	50.47
Total	50.46	49.54	49.53	50.47

* Expressed as t-scores: mean = 50, standard deviation = 10.

TABLE 4.

Average Differences* in Scrambled Sentences Scores for Experimental and Controls Group I and II

	Group I		Group II	
	Experimental	Control	Experimental	Control
Preschool	46.94	47.91	50.52	41.40
Primary	53.74	48.88	51.30	60.82
Less Practice	46.31	48.54	49.26	49.16
More Practice	54.90	48.54	52.79	49.16
Total	51.46	48.54	50.84	49.16

* Expressed as t-scores: mean = 50, standard deviation = 10.

TABLE 5.

Average Syntax Scores* for Experimental and Control Group II

	Group II	
	Experimental	Control
Preschool	51.92	42.17
Primary	54.44	54.44
Less Practice	47.31	47.08
More Practice	58.53	47.08
Total	52.92	47.08

* Expressed as t-scores: mean = 50, standard deviation = 10.

TABLE 6.

Average Differences in Gates Word Recognition Scores for Experimental and Control Groups I and II

	Group I		Group II	
	Experimental	Control	Experimental	Control
Preschool	47.45	48.87	52.55	41.69
Primary	47.74	54.10	53.61	55.03
Less Practice	42.69	52.36	52.12	47.03
More Practice	49.53	52.36	53.82	47.03
Total	47.64	52.36	52.97	47.03

* Expressed as t-scores: mean = 50, standard deviation = 10.

TABLE 7.

Average Differences* in Gates Sentence Scores for Experimental and Control Groups I and II

	Experimental I	Control I	Experimental II	Control II
Preschool	46.92	54.07	53.02	51.13
Primary	49.90	49.60	45.47	48.30
Less Practice	44.28	51.09	56.98	50.00
More Practice	54.47	51.09	43.02	50.00
Total	48.90	51.09	50.00	50.00

* Expressed as t-scores: mean = 50, standard deviation = 10.

TABLE 8.

Mean Differences in Raw Scores between Pretest and Posttest Scores on Language Tests of Experimental and Control Groups I and II

		Experimental I (N=15)	Control I (N=15)	Experimental II (N=10)	Control II (N=10)
Gates Reading Tests: Word Recognition	Mean	4.33	7.67	7.80	3.60
	S.D.	5.87	7.73	5.31	7.91
Gates Reading Tests: Sentence Reading	Mean	1.93	3.40	3.90	3.90
	S.D.	6.87	6.47	6.09	4.59
Picture Vocabulary Test	Mean	1.13	.93	13.70	14.50
	S.D.	1.86	2.46	5.78	6.20
Scrambled Sentences Test	Mean	.73	.13	22.50	20.70
	S.D.	2.79	.72	9.64	11.73
Syntactical Relations Test*	Mean	-	-	11.60	9.10
	S.D.	-	-	4.39	3.78

* Administered only to Groups II at conclusion of program; therefore, not difference scores.

tests. On the Scrambled Sentences test, there was a significant difference between levels ($p<.05$), but the interaction was also significant ($p<.05$).

For Group II which had a greater level of practice, a further analysis of the data appeared warranted. Each subject in the experimental and control groups was assigned a standard score on each of the five tests. These scores were then summed to provide an over-all estimate of gain in language proficiency. The experimental group achieved an average gain score of 253.93 compared to 244.26 for the controls. This difference in average gain across the five tests was significant at less than the .05 level ($t=2.15$, $df=18$). Thus, while the differences between the experimental and control groups were not significant for the subtests, the combined scores did show the predicted difference favoring the experimental group at a statistically significant level. As explained earlier (p. 24), such a result was to be expected in view of the small samples and test reliabilities.

The Paired Associate Program.

In the experiment conducted during the summer of 1963 with 10 preschool children, only suggestive results were obtained. Three of the 10 children failed to complete the typing program. As previously noted, this was due to the fact that their attendance was so sporadic that they had little opportunity for participation.

Of the remaining seven children, four required the entire summer session to achieve the criterion level for typing. The remaining three children were able to spend some time in the paired associate program. The results of their experiences with this program are graphically presented in Figure 5.

It will be noted that one of these children had considerable success. He was able to correctly type three sentences describing pictures which were presented to him. The remaining two children demonstrated that they could type words when presented with the picture alone.

Reading Achievement.

Aside from investigating language gains resulting from programmed instruction, this research also sought to add some data in support of the ability of young deaf children to learn to read. Such data appear in Table 9. The scores are from the widely used Gates tests and are presented in raw score form. These raw scores are converted to Reading Grades, using the norms published by Gates (1943), and are given in Table 10.

It will be noted that the preschool groups at the time of the pretest read as well as children in the first grade, according to the Gates norms for both word recognition and sentence reading. By the end of the language program, both experimental preschool groups I and II had gained on the average about 1/5 of a year in word recognition and 1/10 year or less in sentence reading. The primary groups, of course, were superior to the preschool children at both the pretesting and posttesting.

FIGURE 5

NUMBER OF TRIALS TO REACH VARIOUS CRITERIA IN PAIRED ASSOCIATE PROGRAM

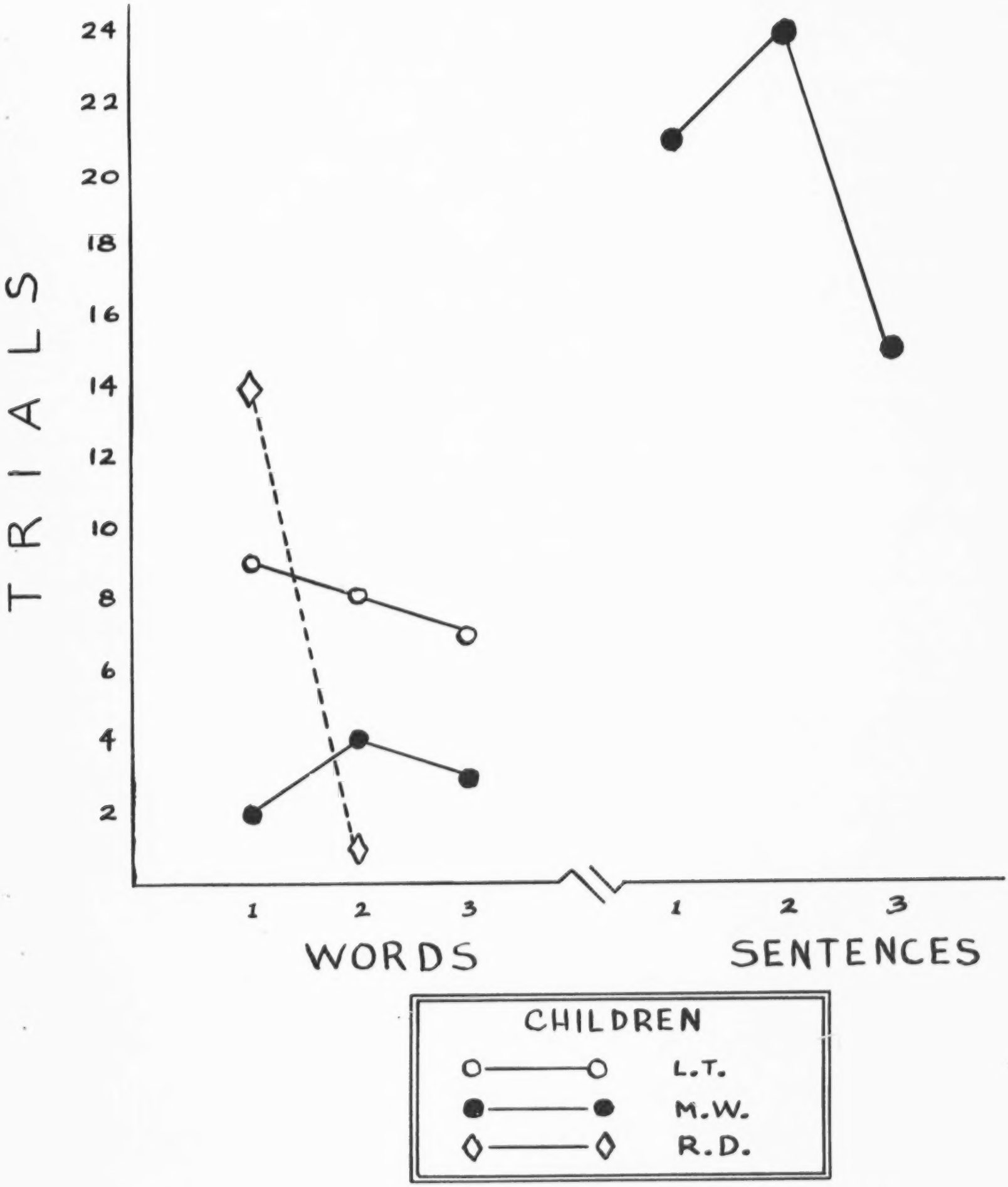


TABLE 9.

Average Gates Reading Test Scores* (Part A: Word Recognition, Part B: Sentence Reading) at Start and End of Experiments with Preschool and Primary Experimental and Control Groups I and II.

	N	Part A		Part B	
		Pretest	Posttest	Pretest	Posttest
Experimental I					
Preschool	5	3.40	7.60	2.00	2.60
Primary	10	17.80	22.20	19.00	21.60
Control I					
Preschool	5	3.40	6.00	.60	6.00
Primary	10	16.90	25.80	19.50	21.90
Experimental II					
Preschool	6	5.17	10.33	9.83	15.30
Primary	4	7.75	16.00	17.25	18.75
Control II					
Preschool	6	3.83	3.50	6.17	11.33
Primary	4	23.50	32.75	27.75	31.50

* Expressed in raw scores: Part A=Number correct - 1/3 Number wrong; Part B=Number correct.

TABLE 10.

Average Gates Reading Grades (Part A: Word Recognition, Part B: Sentence Reading) at Start and End of Experiments with Preschool and Primary Experimental and Control Groups I and II.

	N	Part A		Part B	
		Pretest	Posttest	Pretest	Posttest
Experimental I					
Preschool	5	1.32	1.53	1.30	1.33
Primary	10	2.04	2.24	1.75	1.93
Control I					
Preschool	5	1.32	1.45	1.23	1.45
Primary	10	2.00	2.36	1.78	1.95
Experimental II					
Preschool	6	1.41	1.67	1.52	1.61
Primary	4	1.54	1.95	1.66	1.74
Control II					
Preschool	6	1.34	1.33	1.45	1.53
Primary	4	2.29	2.64	2.28	2.48

To the extent that the Gates is a measure of reading ability, there remains no doubt that the preschoolers as a group are able to read. The average ages for these children were slightly less than six years for the different groupings. The equivalent reading age for a reading grade of 1.3 is 6.5 years, so the young deaf children in this study were accelerated about one-half year on the average.

The small number of children available at ages 3.0 to 3.9 does not permit broad generalization; however, it should be noted that of six such children (three each in the experimental and control groups) three attained reading grades of 1.3 or better on Word Recognition and four on Sentence Reading. Thus, even with this young age group, reading could be demonstrated with the majority of the children.

Discussion

The first part of the section which follows discusses the electronic, mechanical, and subject aspects of this research. The language aspects of the project are then considered and some suggestions for future research offered.

On the basis of earlier reports concerning the use of the typewriter in programmed learning with young hearing children it was assumed by the present investigators that a great deal of free play on the typewriter would occur spontaneously. For reasons that can only be guessed at, this turned out not to be true for the three- and four-year-old subjects in this study. Those under five years required encouragement, approval and repeated assurance that playing with the keyboard was acceptable behavior. Since these children were visually oriented and essentially nonverbal, spoken language from the experimenter did not allay the timidity or anxiety reflected by the children's constricted behavior.

The apparent need for constant reassurance by deaf children in various testing and teaching situations has often been observed, and our experimental setup did not overcome this tendency. It is possible that solely nonverbal, visual and perhaps tactual feedback to the child in early life is less than optimum in promoting a sense of well-being and enough self assurance to risk making errors in unfamiliar situations. However, quantification of the effects of deafness on early psychologic development has

had little research. Although the present study did not attempt to supply evidence on this point, it was apparent that the children below five years in this study showed great reluctance to engage in exploratory behavior. As a result, the experimenter encouraged the child (through demonstration) to engage in free play with the keyboard. Future research with programmed learning in young deaf children, therefore, should take this experience into account.

Problems relating to the mechanical and electronic aspects included self correction of inappropriate responses and provision for immediate visual feedback. The former was met by placing a switch under the experimenter's control between the master typewriter and the slave. In this way it was possible to control the results of the child's keyboard actions without overt (to the child) behavior by the experimenter. The immediate visual feedback was provided by the television hookup described. These steps proved to be satisfactory solutions to these two problems in the typing phases of the study. The Wycoff Film Tutor, as described in the section on methodology, was used in the programmed language phase of the research to meet these same requirements with less elaborate equipment.

The typewriter, in contrast to the Film Tutor used in this study, has an important feature which should be emphasized. An eventual goal is to have deaf children produce compositions spontaneously. With all the keys in the "open" position the subject

has free access to create and produce what he wishes on the electric typewriter. The Film Tutor, on the other hand, does not allow free expression. Its chief merit lies in the fact that it is an economical training device capable of bringing children to the point where creativity is possible. Its effectiveness, as demonstrated in the language experiment, will justify the cost and time necessary to prepare the programmed filmstrips. Reproduction of the filmstrips is, fortunately, relatively inexpensive.

For the benefit of future researchers, the necessity for the televised projection used in this study should be questioned. Perhaps equally good results could be achieved by permitting the child to view directly what he typed. Controlling the keyboard action is of prime importance in this type of research and could be achieved with only a single switch with which the experimenter can turn on or off the typewriter's power supply. But the necessity for the televised visual feedback is questioned principally because of the cost involved, the maintenance required, and the essential non-portability of the system. Further investigations are likely to lead to equipment meeting the requirements felt necessary here with less expense and, probably, less complexity.

The verbal language deficit of congenitally deaf children and those who become deaf prior to the natural development of speech is well known. That this language retardation is extremely difficult to overcome is illustrated by an educational gap which

persists throughout the school years of most such deaf persons. Deafness does not preclude the development of verbal skills and the consequent development of language and general knowledge, but it does present a formidable obstacle to the ready acquisition of these skills. The deaf child, as defined in this study, is dependent upon vision as the primary sense modality for the intake of verbal data and the ultimate development of the verbal set of symbols (language) peculiar to his culture.

For the most part, the early exposure to the child's native tongue is through the process of speechreading (lipreading). This is the principal means of verbal language intake until the child learns to read. However, two factors are of primary importance: (a) the eye (used in speechreading) is an inefficient replacement for the ear in perceiving spoken signs. In terms of information theory there is too much "noise" and a resultant breakdown in the positive effects of redundancy on comprehension. (b) The deaf child experiences a dearth of properly sequenced verbal symbols (words) until he learns to read independently; i.e., he does not have the sensory equipment to perceive (through audition and vision) accurately and thus to acquire naturally the grammatical and syntactical peculiarities of his language. Because he does not receive language accurately he cannot express it correctly. He does not develop easily (in contrast to the hearing child) a means of expressing the language clearly, because the efficiency of his ears as monitoring devices for his

own speech output is reduced or absent. In brief, he has a double communication handicap; difficulty in reception and difficulty in expression of language. Ambiguity exists for him as a receiver of the speech of others and ambiguity exists for others who listen to his speech. It is within this general framework that this research has significance to the areas of special education, psycholinguistics, psychology, audiology, speech pathology, and anthropology.

The hypothesis tested was that programmed instruction could hasten the acquisition of verbal language in young deaf children. The number of discrete verbal stimuli per unit time reaching the brain of a young hearing child is astronomical in comparison to that of the deaf child. This deficit results from the absence of an unambiguous communication system as a replacement for or as a supplement to defective hearing. The letters of the typewriter keyboard and the concomitant visual feedback have the theoretical potential for providing the framework for an unambiguous verbal symbol system in deaf children.

The visual perception and neuromuscular motility of deaf children required in the task of typing was shown to be within the capabilities of those as young as three years of age. This research demonstrated, therefore, that an unambiguous visual stimulus (a base from which knowledge of one's native language might be developed) could become available to the deaf child and to other persons in his environment very early in life. It should

be emphasized that the fundamental verbal base of the English language (the alphabet) thus becomes for the child an unambiguous sign for sending as well as receiving messages.

Through the use of the alphabet as represented on the typewriter keys, preschool and primary school deaf children demonstrated the ability to type words, word combinations, and sentences. For the most part this was typing from the programmed verbal model. The reaction of the three and four year olds (who were essentially nonverbal at the outset of the experiment) in large measure was one of copying letters. However, those above four years who had some outside knowledge of verbal labels tended to perceive the stimuli as whole words rather than a string of "unrelated" consecutive letters. Specifically, children five years of age and above seemed to grasp more readily than those below five years the concept of a word contrasted with a series of letters. On the basis of the relatively short time afforded each subject (an average of 10 hours of language instruction for Experimental Group II) it is not possible to state whether this difference in readiness is real or apparent. Since learning to type required a longer time for the three and four year olds, it is possible that an extended run could bring them up to the level of "word perception" as contrasted with "letter perception". On the other hand, learning might have been more rapid had the younger children been exposed intensively to printed symbols prior to the language program as were the older

children. The latter had been receiving instruction in speechreading, auditory training, speech, and silent reading for two to four years.

This general observation poses the question of the appropriate size of the language unit to be initiated with deaf children. The language-unit-size variable requires further study, particularly below five years of age in children who are learning language through vision. An implication resulting from observations in this research is that the teaching of vocabulary, sentence structure, and the meaning of sentences in the preschool classroom, if correlated with the specific programmed reading material, might enhance the development of language even beyond that suggested by the results of the present study.

The language program designed for use in this research sought to establish the sense of the simple declarative sentence (which also included a change in verb tense). It appeared that this level of sentence complexity was sufficiently greater than the language level brought to the experiment by the preschool children. However, the six and seven year olds in the primary school program were already involved in reading and constructing simple sentences. In this sense the language program might have been geared too low for the primary group, reducing the net impact of the program for the experimental subjects. Further research is essential to clarify the program variables as they relate to different academic levels. Evoking language and

shaping language are not necessarily the same thing, and to some extent our observations bear this out. Further research should integrate the programmed content into the over-all preschool program involving specific training in speech, residual hearing, silent reading and speechreading.

There does not remain any question that the preschool deaf child can learn to read. But whether or not the program used in this research is more effective than the traditional method or some other methods for introducing language has not been unequivocably resolved by our results. It should be emphasized, however, before discarding the present method, that very little time was actually used for the instruction of each child. Furthermore, this particular program is probably most appropriate for children who have not yet had formal language instruction, such as the preschool children used in this study. In spite of this, a statistically significant gain in favor of the experimental group was achieved in the second run of the program which had more time devoted to it.

It appears to us, in the case of deaf children, as it has to Pressey (1963) in the case of those with normal hearing, that programmed learning should be used as an adjunct to regular instruction, rather than as the principal means of relatively greater theoretical importance to the deaf than to the hearing child because of the very little, if any, incidental verbal learning which accrues to the deaf youngster. In addition,

because of the increased need for individual tuition which results from the communication handicap, much "dead" classroom time occurs when the teacher is involved with a single student. If the other students cannot see both the teacher and the student she is working with they lose that part of the class time. Self-instructional techniques such as those tried in this study would seem to be most useful in such a classroom situation.

The program which was developed for this experiment had very limited objectives in view of the short period of time during which it could be applied. The program, therefore, concentrated on developing a sense of the simple, declarative sentence. In future research, the program should be broadened to include syntactical forms. It should also be planned for use over a period of years rather than a few months. Most of all, our experience suggests that the next step should be the close coordination of the programmed instruction into the regular curriculum. In conjunction with this step should be the use of a device like the typewriter to provide the child with the opportunity for free expression of unambiguous verbal symbols whose production he can observe as well as initiate.

Summary and Conclusions

The handicap of prelingual deafness presents one of the most severe challenges to education, for it interferes with the development of the principal teaching vehicle, language. This project undertook to investigate some recent innovations in teaching language. The techniques of programmed instruction were merged with the use of an electric typewriter to provide the means of teaching reading---the aspect of language chosen for study---to young deaf children.

Previous research has demonstrated that young children have the ability to use a typewriter. Evidence has also been presented that deaf children somewhat older than those in this study and young hearing children can profit from programmed language instruction. Taken together these two lines of research provided the framework for this project.

All of the children who served in this study as subjects had better-ear-average losses of 70 decibels or more. These children were enrolled in the Kendall School or in the Hearing and Speech Center Preschool. They ranged in age from three to seven years. As a group they tended to be of about average intelligence and socio-economic status.

Four subprojects were designed to provide information about various aspects of deaf children's language development under programmed instruction. One project concentrated on teaching typing, while the other three were devoted to various means of language instruction.

For all but the first approach to language instruction, it was first decided to teach the child how to manipulate the typewriter before he was exposed to the language program. The typing program followed a series of steps: (a) Acquainting the child with the fact that when he typed a letter correctly it would appear at eye level on a television screen in front of him. (b) The child was then taught finger placement by not permitting the keys to operate if they were struck with the wrong fingers. (c) Typing groups of letters was then introduced, and the child continued until he reached a criterion level for typing five-letter words. Twenty-eight of the 33 children who were given this training reached the criterion level. All five of the children who did not satisfactorily complete the training were under five years of age, and it is possible that, if they had had more time than was allotted to them, they could have succeeded. The three-year-old children achieved the criterion with four hours of training on the average; those from four to seven years of age did so with an average training time of about two hours.

An attempt to use a relatively unstructured approach to the use of the equipment was completely unsuccessful with the younger children. The results were so uniformly negative with the first three children under five years of age who were introduced to the typewriter by this method that it was abandoned. The children constantly sought the reactions of the experimenter and refused to

proceed when these responses were not forthcoming. In the "free play" or completely permissive situation, the young children were timid and their behavior characterized by constriction and rigidity.

Two programs were then developed with the freedom of the experimenter to intervene accepted as a part of the instructional regimen. The linear language program consisted of a series of words which were followed at appropriate points by pictures illustrating the object or action the words described. This series led up to a complete sentence in simple, declarative form. The first step in the program was the presentation of a noun with its appropriate article. When the child successfully typed the phrase, a picture of the object named was shown. The next sequence consisted of an article, adjective and noun. The picture then shown differed by the inclusion of the characteristic which the adjective described. In the next sequence an article, adjective, noun, and verb phrase was shown. A brief movie was projected following this sequence. The child then typed the same sentence with the verb tense changed to past tense. This sequence was repeated for 44 sets, each differing in some elements of the sentences given.

Initially, 15 children went through this language program. The experimental children were matched as a group with 15 control subjects. The differences in the gains made on four measures of language ability were not significantly different between the experimentals and controls. However, none of the children had an

opportunity to complete all 44 sequences within the program, so a second group of 10 children, again matched with 10 controls, was given the language training. At the conclusion of their training the language gains made by the experimental group significantly exceeded those of the matched control group, who were being taught by traditional methods in the classroom only, on over-all score of language abilities.

Another language program was developed which placed greater emphasis on the child's expression. In this program a picture was shown which was followed in 10 seconds by its name. At first the child copied the name, but later he was expected to anticipate the exposure of the correct response and to type it before it appeared. Naming of objects was followed by typing sentences describing the action in pictures similarly projected. Again the child was to type the appropriate response after being shown a picture. Of the 10 children who were given this training, only three progressed beyond learning to type in the allotted time. Of the three, two were able to type the names of objects from memory after being shown the picture, and one reached the level of typing a sentence describing action in the pictures shown.

The question as to whether or not children as young as three years of age can learn to read was also posed. Perhaps because the answer is so taken for granted, there are little empirical data on this point. The results of our study indicate that children of this age can perform on the average as well as hearing children advanced at least half way through the first grade. This

finding was based on the children's performance on the Gates Reading tests.

While no single piece of research can expect to successfully resolve complex questions, studies reported here do provide considerable encouragement on a number of points. First of all, there seems to be little doubt that young deaf children can learn to use an electric typewriter within a very short period of time. This instrument does not require more mental nor physical ability than the average deaf three-year-old seems to have.

As to how best to use this typing skill, the results of our investigations seem to indicate that programmed instruction can produce significant improvement in language; however, the possibilities for using the typewriter in such instruction are far greater than the few which were attempted here. Both from observations made of the children and from theoretical considerations, it would appear that the most successful approach for language instruction of this group of children would be to include the typewriter as a part of the language program. Such a curriculum would coordinate language exercises on the typewriter with current methods of imparting language to these children. The typewriter should be used initially in a program which requires little more than that the child copy the programmed material. Later, however, the child should be encouraged in the creative use of this instrument, to provide an expressive outlet which the teacher can use in shaping his language. Typewritten material appears to have the advantage of providing an unambiguous record, both to the child and to his teacher, which can be an important adjunct in his further instruction.

References

Anderson, A. R. and Moore, O. K. Autotelic folk-models. Sociol. Quart., 1, 1960, 203-216.

Butkevich, N. G. Instruction of children of preschool age in typewriting as one means of their forming connected speech. In Text of Reports, Third Scientific Session on Questions of Defectology. Moscow: Academy of Pedagogical Science, 1960. Cited in dsh Abstracts, 1, 1961, 224. Abst. No. 781.

Conklin, C. Speech and language for deaf children: Problems of the educator, The Washingtonian, April, 1963, 1-3.

Doerfler, L. The effect of the use of the typewriter upon the reading and language of deaf children. M. S. Thesis. Washington University, 1941.

Erickson, L. W. Typewriting in elementary school? Nat. Educ. Ass. J., 51, 1958, 54-56.

Falconer, G. E. A mechanical device for teaching sight vocabulary to young deaf children. Amer. Ann. Deaf, 106, 1961, 251-257.

Fowler, W. Teaching a two-year-old to read: An experiment in early childhood learning. Genet. Psychol. Monogr., 66, 1962, 181-283.

Gates, A. I. Gates Primary Reading tests manual of directions. New York: Bureau of Publications, Teachers College, Columbia University, 1943. Pp 45.

Grewel, F. Remarks upon the acquisition of language in deaf children. Lang. Speech, 6, 1963, 37-45.

Korsinskaya, B. D. On methods of teaching speech to deaf children of preschool age. In Text of Reports, Third Scientific Session on Questions of Defectology. Moscow: Academy of Pedagogical Science, 1960. Cited in dsh Abstracts, 1, 1961, 225-226. Abst. No. 781.

Moore, O. K. and Anderson, A. R. Early reading and writing. Part I. Skills. Part II. Teaching methods. Part III. Development. Guilford, Conn.: Basic Education, 1960. Motion pictures.

Myklebust, H. R. The psychology of deafness. New York: Grune & Stratton, 1960. Pp 387.

Pressey, S. L. Teaching machine (and learning theory) crisis. J. appl. Psychol., 47, 1963, 1-4.

Stolurow, L. M. Teaching by machine. Cooperative Research Monograph No. 6. Washington, D.C.: U.S. Office of Education, Department of Health, Education, and Welfare, 1961. Pp 173.

Stuckless, E. R. and Birch, J. W. A programmed approach to written language development in deaf children. Volta Rev., 64, 1962, 415-416.

McNemar, Q. Psychological statistics. Third edition. New York: John Wiley & Sons, 1962. Pp 86-88.

Appendix A

PROGRAMMED INSTRUCTION IN TYPING

Objectives:

1. To familiarize the child with the typewriter keyboard.
2. To teach the child to strike the keys with the appropriate fingers.
3. To develop skill in typing.

Materials:

1. The electric typewriter, TV camera hookup, slide projector and prepared slides.
2. Programmed materials including:
   a. Color slides of large colored disks: red, green, lavender, orange, blue and yellow.
   b. Color slides for each letter of the alphabet (each letter is shown in the color its key is printed).
   c. Black and white slides, one for each letter of the alphabet.
   d. Six black and white slides showing 5 letters each.
   e. Twelve black and white slides showing groups of 3, 4 or 5 letters.

Steps in training:

1. Permit child to play with the typewriter. When he strikes a key, the screen will light up. Show interest and delight at child's accomplishment. Encourage him to strike keys and direct his attention to what is happening on the TV screen each time he hits a key.
2. As soon as it is apparent that the child sees the connection between his striking a key and what appears on the screen, begin to apply stimulus control by the following steps:
   a. Project a red circle on the screen and lock out all keys except those colored red. Encourage the child to continue striking the keys. (Only the red keys will respond).
   b. Repeat the process for each of the colors in order.
   c. Paint the nail of the child's right index finger red. Lock all except red keys. If the child moves to strike a red key with other than his right index finger, lock out the particular key so nothing happens when he hits it. Continue until the child strikes five red keys in succession with his right index finger.
   d. Paint the nail of the left index finger with the appropriate color and repeat the procedures as given for the right index finger.
   e. Continue in the same way for all fingers and all colors.

3. Individual letters.

a. Project one of the letters in the "red" category onto the screen. Paint nail of right index finger red. Lock all keys except the one for that letter. If the child moves to strike the key with any other than the right index finger, lock the key. As soon as the child strikes the key correctly, project the next letter in the red category. Criterion for success is five consecutive correct hits.

b. Project one of the letters in green category. Paint the nail of the left index finger green. Project one of the letters in the green category onto the screen. Lock all keys except the one for that letter. Permit the child to strike the key only with appropriate finger. As soon as the correct key is struck, change to the next letter in the green category. The criterion is five consecutive correct hits.

c. Repeat the procedure outlined above (3a and 3b) for the remaining fingers and letters.

4. Fingering exercise.

a. Letters jkl.

(1) Paint all of the fingernails appropriately.

(2) Project on the screen the combinations jkl, klj, ljk.

(3) Require correct fingering. Criterion for moving to next step is three consecutive groups typed correctly.

b. Letters sdf

(1) Paint all fingernails.

(2) Show letters sdf, dfs, fsd.

(3) Criterion: three consecutive groups typed correctly.

c. Two groups of letters interchangeably.

(1) Paint all fingernails.

(2) Show letter groups in this order:

jld,
ksf,
ldj,
sfk,
djl,
fks.

(3) Criterion: three consecutive correct groups typed correctly after all groups have been presented at least once.

d. Inclusion of letter "a"

(1) Paint all fingernails.

(2) Show groups in this order:

ajk
sda
fal
kaj
asd
laf

(3) Criterion: three consecutive groups typed correctly after all groups have been presented at least once.

5. Practice for skill.
   a. Use slides with words printed on them.
   b. Present in this order:

	a	b	c	d	e
	Order of trials				
dog	1	4	10	25	34
bird	2	6	12	27	37
boy	3	8	18	30	40
ball	5	14	22	33	43
apple	7	16	24	36	46
house	9	20	29	39	48
chair	11	21	32	42	50
car	13	23	35	45	52
baby	15	26	38	47	53
tree	17	28	41	49	54
girl	19	31	44	51	55

   c. Manner of presentation.
      (1) Project word on screen.
      (2) Lock all except pertinent key.
      (3) Immediately upon completion of a word, project next word on the screen.
      (4) If child does not begin to type the word in five seconds, replace the word with the next in the list.
      (5) Criterion: every word in the list typed correctly five times.

APPENDIX B

PROGRAM FOR TMI

1. A DOG
   THE BLACK DOG
   THE BLACK DOG IS RUNNING
   THE BLACK DOG RAN

2. A DOG
   THE WHITE DOG
   THE WHITE DOG IS RUNNING
   THE WHITE DOG RAN

3. A DOG
   THE BLACK DOG
   THE BLACK DOG IS EATING
   THE BLACK DOG ATE

4. A DOG
   THE WHITE DOG
   THE WHITE DOG IS EATING
   THE WHITE DOG ATE

5. A CAT
   THE BLACK CAT
   THE BLACK CAT IS RUNNING
   THE BLACK CAT RAN

6. A CAT
   THE WHITE CAT
   THE WHITE CAT IS RUNNING
   THE WHITE CAT RAN

7. A CAT
   THE BLACK CAT
   THE BLACK CAT IS EATING
   THE BLACK CAT ATE

8. A CAT
   THE WHITE CAT
   THE WHITE CAT IS EATING
   THE WHITE CAT ATE

9. A BIRD
   THE RED BIRD
   THE RED BIRD IS FLYING
   THE RED BIRD FLEW

10. A BIRD
THE GREEN BIRD
THE GREEN BIRD IS EATING
THE GREEN BIRD ATE

11. A BIRD
THE WHITE BIRD
THE WHITE BIRD IS FLYING
THE WHITE BIRD FLEW

12. A BIRD
THE BROWN BIRD
THE BROWN BIRD IS EATING
THE BROWN BIRD ATE

13. A BEAR
THE BROWN BEAR
THE BROWN BEAR IS WALKING
THE BROWN BEAR WALKED

14. A BEAR
THE WHITE BEAR
THE WHITE BEAR IS SLEEPING
THE WHITE BEAR SLEPT

15. A BEAR
THE BLACK BEAR
THE BLACK BEAR IS EATING
THE BLACK BEAR ATE

16. A BEAR
THE WHITE BEAR
THE WHITE BEAR IS SLEEPING
THE WHITE BEAR SLEPT

17. A COW
THE RED COW
THE RED COW IS WALKING
THE RED COW WALKED

18. A COW
THE WHITE COW
THE WHITE COW IS EATING
THE WHITE COW ATE

19. A COW
THE BLACK COW
THE BLACK COW IS WALKING
THE BLACK COW WALKED

20. A COW
THE BROWN COW
THE BROWN COW IS EATING
THE BROWN COW ATE

21. A HORSE
THE WHITE HORSE
THE WHITE HORSE IS RUNNING
THE WHITE HORSE RAN

22. A HORSE
THE BLACK HORSE
THE BLACK HORSE IS EATING
THE BLACK HORSE ATE

23. A HORSE
THE BROWN HORSE
THE BROWN HORSE IS EATING
THE BROWN HORSE ATE

24. A HORSE
THE WHITE HORSE
THE WHITE HORSE IS WALKING
THE WHITE HORSE WALKED

25. A BOAT
THE WHITE BOAT
THE WHITE BOAT IS SAILING
THE WHITE BOAT SAILED

26. A BOAT
THE RED BOAT
THE RED BOAT IS SAILING
THE RED BOAT SAILED

27. A BOAT
THE GREEN BOAT
THE GREEN BOAT IS SAILING
THE GREEN BOAT SAILED

28. A BOAT
THE RED BOAT
THE RED BOAT IS MOVING
THE RED BOAT MOVED

29. A CAR
THE BLACK CAR
THE BLACK CAR IS MOVING
THE BLACK CAR MOVED

30. A CAR
THE WHITE CAR
THE WHITE CAR IS MOVING
THE WHITE CAR MOVED

31. A CAR
THE GREEN CAR
THE GREEN CAR IS MOVING
THE GREEN CAR MOVED

32. A CAR
THE RED CAR
THE RED CAR IS MOVING
THE RED CAR MOVED

33. A BOY
THE BOY IS WALKING
THE BOY WALKED

34. A BOY
THE BOY IS RUNNING
THE BOY RAN

35. A BOY
THE BOY IS SLEEPING
THE BOY SLEPT

36. A BOY
THE BOY IS READING
THE BOY READ

37. A GIRL
THE GIRL IS WALKING
THE GIRL WALKED

38. A GIRL
THE GIRL IS RUNNING
THE GIRL RAN

39. A GIRL
THE GIRL IS SLEEPING
THE GIRL SLEPT

40. A GIRL
THE GIRL IS READING
THE GIRL READ

41. A MAN
THE MAN IS WORKING
THE MAN WORKED

42. A MAN
THE MAN IS READING
THE MAN READ

43. A MAN
THE MAN IS WALKING
THE MAN WALKED

44. A MAN
THE MAN IS EATING
THE MAN ATE

45. A WOMAN
THE WOMAN IS WORKING
THE WOMAN WORKED

46. A WOMAN
THE WOMAN IS READING
THE WOMAN READ

47. A WOMAN
A WOMAN IS WALKING
THE WOMAN WALKED

48. A WOMAN
THE WOMAN IS EATING
THE WOMAN ATE

49. A BALL
THE RED BALL
THE RED BALL IS ROLLING
THE RED BALL ROLLED

50. A BALL
THE GREEN BALL
THE GREEN BALL IS ROLLING
THE GREEN BALL ROLLED

51. A BALL
THE BLUE BALL
THE BLUE BALL IS ROLLING
THE BLUE BALL ROLLED

52. A BALL
THE WHITE BALL
THE WHITE BALL IS ROLLING
THE WHITE BALL ROLLED

53. A PLANE
THE WHITE PLANE
THE WHITE PLANE IS FLYING
THE WHITE PLANE FLEW

54. A PLANE
THE RED PLANE
THE RED PLANE IS FLYING
THE RED PLANE FLEW

55. A PLANE
THE WHITE PLANE
THE WHITE PLANE IS MOVING
THE WHITE PLANE MOVED

56. A PLANE
THE RED PLANE
THE RED PLANE IS MOVING
THE RED PLANE MOVED

NOUNS

DOG - 16
CAT - 16
BIRD - 16
BEAR - 16
COW - 16
HORSE - 16
BALL - 16
BOAT - 16
BOY - 12
GIRL - 12
MAN - 12
CAR - 16
WOMAN - 12
PLANE - 6

VERBS

IS RUNNING - 7
RAN - 7
IS EATING - 13
ATE - 13
IS FLYING - 4
FLEW - 4
IS WALKING - 8
WALKED - 8
IS SLEEPING - 4
SLEPT - 4
IS SAILING - 4
SAILED - 4
IS MOVING - 6
MOVED - 6
IS WORKING - 2
WORKED - 4
IS READING - 4
READ - 2
IS ROLLING - 4
ROLLED - 4

ARTICLES

A - 58
THE - 174

ADJECTIVES

BLACK - 24
WHITE - 42
RED - 21
GREEN - 12
BROWN - 12
BLUE - 3

Appendix C

PROGRAM FOR PAIRED-ASSOCIATE LEARNING

Objectives:

1. To teach word meanings.
2. To teach production of language elements in response to nonverbal stimuli.
3. To begin the process of connecting nouns and verbs.

Materials:

1. Electric typewriter and TV hook-up.
2. Two carrousel slide projectors.
3. The following 35mm slides.

a.

Pictures	Words
(1) a cat	(1) CAT
(2) a dog	(2) DOG
(3) a cow	(3) COW

b.

Pictures	Words
(1) a cat eating	(1) CAT IS EATING
(2) a dog eating	(2) DOG IS EATING
(3) a cow eating	(3) COW IS EATING

c.

Pictures	Words
(1) a white cat eating	(1) THE WHITE CAT IS EATING
(2) a black dog eating	(2) THE BLACK DOG IS EATING
(3) a brown cow eating	(3) THE BROWN COW IS EATING

Preparation:

1. Load the carrousels by putting all picture slides in one in the order given in 3a, b, c and all the word slides in the other projector in the specified order.
2. Paint the child's fingernails to match the colored keys of the typewriter.

Procedures:

1. Show picture slide 3a(1) on the screen.
2. Indicate to the child that he is to type the name of the picture.
3. After 10 seconds project word slide 3a(1) on the screen alongside the picture. Indicate to the child that he is to type the word.
4. As soon as the child types the first word, project the next picture slide, 3a(2). Wait 10 seconds, then project the matching word slide. Indicate to the child that he is to copy it as before.
5. Repeat these procedures until five correct typings of the word are made prior to the appearance of the word slide on the screen.
6. Present the group 3b(1), (2), and (3) in the specified order and in the same manner as the first group was presented. Criterion is five correct typings before the word slides appear.
7. Present group 3c(1), (2), and (3) in the order specified and in the same manner as before. Criterion is five correct typings before the slides appear.

Appendix D

Special tests developed to measure language functions of children in the Linear Language Program.*

1. Picture Vocabulary Test

2. Scrambled Sentences Test

3. Syntactical Relations Test

---

* The Gates Primary Reading tests, which were also part of the language battery, are standard tests and, therefore, not described here. The description of these tests will be found in the test manual by Gates (1943).

PICTURE VOCABULARY TEST

This test consists of four parts:

Part I - Nouns
Part II - Verbs (Present perfect)
Part III - Adjectives (Colors)
Part IV - Verbs (Past tense)

Part I - Nouns

Materials: 5"x5" photographs of:

CAR	WOMAN
BALL	BOAT
PLANE	BIRD
MAN	GIRL
DOG	CAT

Cards: Each card printed with the name of the pictured object and three distractors (incorrect answers.)

Directions:

1. Place the first picture on the desk in front of the child and the response card just below the picture.
2. Indicate by gestures that the child is to point to the word on the response card that names the pictured object.
3. Continue in this way through the entire list.
4. Score is the number of correct responses.

Test

Item	Alternatives	Item	Alternatives
1. CAR	COW	4. MAN	MAN
	CAT		BALL
	DOG		PLANE
	CAR		CAT
2. BALL	BOAT	5. DOG	BEAR
	BALL		WOMAN
	BIRD		DOG
	BEAR		MAN
3. PLANE	GIRL	6. WOMAN	BALL
	DOG		BOY
	PLANE		WOMAN
	CAR		CAR

Item	Alternatives	Item	Alternatives
7. BOAT	BOAT	9. GIRL	GIRL
	PLANE		BIRD
	MAN		WOMAN
	BIRD		DOG
8. BIRD	COW	10. CAT	CAR
	GIRL		CAT
	BOY		BEAR
	BIRD		MAN

Part II - Verbs (Present tense)

Materials:

8 mm motion picture showing:

A DOG RUNNING	A BOAT SAILING
A CAT EATING	A PLANE MOVING
A PLANE FLYING	A WOMAN WORKING
A BOY WALKING	A GIRL READING
A BOY SLEEPING	A BALL ROLLING

Cards: Each card is printed with a phrase correctly describing what is occurring in the picture and three incorrect phrases.

Directions:

1. The child is shown the motion picture of a dog running. While it is on the screen the child is given a card with the four phrases on it. He is asked to point to the phrase which describes the action taking place.
2. Proceed with each picture and response card in the order of the test.
3. Score is the number of correctly identified phrases.

Test

Item	Alternatives	Item	Alternatives
1. DOG RUNNING	IS SAILING	4. BOY WALKING	IS SAILING
	IS WORKING		IS READING
	IS RUNNING		IS WORKING
	IS WALKING		IS WALKING
2. CAT EATING	IS EATING	5. BOY SLEEPING	IS ROLLING
	IS ROLLING		IS SLEEPING
	IS MOVING		IS EATING
	IS FLYING		IS FLYING
3. PLANE FLYING	IS FLYING	6. BOAT SAILING	IS SAILING
	IS RUNNING		IS WALKING
	IS SLEEPING		IS EATING
	IS READING		IS RUNNING

Item	Alternatives	Item	Alternatives
7. PLANE MOVING	IS SLEEPING IS EATING IS READING IS MOVING	9. GIRL READING	IS RUNNING IS FLYING IS READING IS MOVING
8. WOMAN WORKING	IS WORKING IS ROLLING IS MOVING IS SAILING	10. BALL ROLLING	IS WORKING IS SLEEPING IS ROLLING IS WALKING

Part III - Adjectives (Colors)

Materials:

Six 3"x6" colored papers: black, white, red, green, brown and blue.

Cards: Each card is printed with the names of four colors, one of which is the name of the color to be shown.

Directions:

1. Place a colored paper and a response card before the child and ask him to identify by pointing to the name of the color shown.
2. Continue through the six colors in the order printed below.
3. Score is the number of correctly identified color names.

Test

Items	Responses	Items	Responses
1. BLACK	RED BROWN BLACK GREEN	4. GREEN	GREEN WHITE BLUE BROWN
2. WHITE	WHITE BLACK BLUE RED	5. BROWN	GREEN BLUE BLACK BROWN
3. RED	WHITE BLACK RED BROWN	6. BLUE	BLUE RED GREEN WHITE

Part IV - Verbs (Past tense)

Materials:

8 mm motion picture showing:

A BALL ROLLING	A MAN READING
A MAN WORKING	A CAR MOVING
A BOAT SAILING	A GIRL SLEEPING
A GIRL WALKING	A PLANE FLYING
A MAN EATING	A BOY RUNNING

Cards: Each card bears the correct verb and three distractors.

Directions:

1. Show the motion picture of a ball rolling. Stop the projector after the ball has come to rest and present the child with the response card. Ask him to indicate which verb describes the action he saw.
2. Continue through the test in the order given.
3. Score is the number of correctly identified verbs.

Test

Items	Alternatives	Items	Alternatives
1. A BALL ROLLING	ATE FLEW READ ROLLED	6. A MAN READING	SLEPT RAN ATE READ
2. A MAN WORKING	SAILED ROLLED WORKED WALKED	7. A CAR MOVING	MOVED RAN SAILED ROLLED
3. A BOAT SAILING	SAILED WORKED SLEPT READ	8. A GIRL SLEEPING	ATE SAILED SLEPT RAN
4. A GIRL WALKING	MOVED WALKED ROLLED FLEW	9. A PLANE FLYING	READ WORKED WALKED FLEW
5. A MAN EATING	ATE WORKED MOVED WALKED	10. A BOY RUNNING	SLEPT RAN FLEW MOVED

Appendix D

Scrambled Sentences Test

Materials:

Eleven sets of four or five cards each. One word is printed on each card.

Directions:

1. Present the sample set of four cards to the child in the order noted.
2. Indicate by gestures and facial expressions that something is wrong with the order of the cards and that he is to put them in order.
3. If the child succeeds in putting the cards in the correct sequence, continue with the first test item. If not, put the cards in correct order, being certain he observes what is being done, then re-arrange the cards in the original way and indicate he is to put them in order. Repeat once more if necessary (a total of three tries with the sample), then proceed to the first test item, regardless of whether or not the child puts the sample items in the proper sequence on this third attempt.
4. Score is number of correct placements; maximum possible score is 45.

Test (items typed in order they should appear to the child.)

Sample: dog the black runs
1. sleeps the cat white
2. the boat sails blue
3. black runs horse the
4. cow brown the eats
5. red ball the rolls
6. plane red is flying the
7. is dog sleeping the white
8. running the is white cat
9. the sailing is red boat
10. blue the rolling is ball

Appendix D

Syntactical Relations Test

Materials:

Twenty-two cards containing sentences with missing words indicated by blank spaces, and three alternative responses.

Directions:

1. Present to the child the first sample card. Indicate that he is to point to the word that correctly belongs in the blank space.
2. If he selects the correct alternative, praise him and proceed to the second sample.
3. If he fails to select the correct alternative or does not seem to understand the task, indicate the correct response. The child should point to the correct alternative on the first sample, if at all possible, before moving to the second sample.
4. Whether or not the child succeeds on the second sample card, proceed to the test items.
5. Score one point for each correct response. No partial credit is given.

Test

Item		Alternatives
Sample I	The white dog_____	ran black cat_____
Sample II	The red_____moved.	black plane ran_____
1.	The_____dog is eating.	red cow ate_____
2.	The white cat is_____	black woman sleeping_____
3.	The red_____is moving.	white ball read_____
4.	_____man walked.	a cat rolling_____

Test

Item		Alternatives
5.	The woman_____moving.	the man is_____
6.	The_____is working.	red boy ran_____
7.	The red bird is_____	black plane walking____
8.	The brown_____is sleeping	red cow moving_____
9.	_____black dog slept.	the cat ate_____
10.	The_____cat is walking.	brown bear flying____
11.	The_____is eating.	white girl flew_____
12.	The black car is_____	red boat running___
13.	The green_____is moving.	blue boat flew_____
14.	The black plane is_____	blue bear rolling____
15.	The_____cow walked.	red boat ate_____
16.	The woman_____	red cat ran_____

Test

Item		Alternatives
17.	The blue_____is flying.	black plane slept_____
18.	The blue bird_____	red cat walked_____
19.	The_____man slept.	white car ran_____
20.	The_____moved.	red car ran_____
21.	The_____boat is sailing.	blue ball read_____
22.	The_____is sleeping.	green man ate_____